DEFENSE INFORMATION SYSTEMS AGENCY
JOINT INTEROPERABILITY TEST COMMAND
P.O. BOX 12798
FORT HUACHUCA, ARIZONA 85670-2798

IN REPLY REFER TO:

Battlespace Communications Portfolio (JTE) 8 January 2008

MEMORANDUM FOR DISTRIBUTION

SUBJECT: Special Interoperability Test Certification of the Cisco Optical Network System (ONS) 15454 with Software Release 8.0.0 (08.00-007A-27.16)

References: (a) DoD Directive 4630.5, "Interoperability and Supportability of Information Technology (IT) and National Security Systems (NSS)," 5 May 2004
(b) CJCSI 6212.01D, "Interoperability and Supportability of Information Technology and National Security Systems," 8 March 2006

1. References (a) and (b) establish the Defense Information Systems Agency (DISA), Joint Interoperability Test Command (JITC), as the responsible organization for interoperability test certification. Additional references are provided in enclosure 1.

2. The Cisco ONS 15454 with Software Release 8.0.0 (08.00-007A-27.16) is hereinafter referred to as the System Under Test (SUT). The SUT can be configured in the following two platforms: the Synchronous Optical Network (SONET)/Synchronous Digital Hierarchy (SDH) Multiservice Provisioning Platform (MSPP) and the Multiservice Transport Platform (MSTP). Both the SONET/SDH MSPP and the MSTP platform configurations were tested and are covered under this certification. The SUT meets all of the critical interoperability requirements for the Defense Switched Network (DSN) and is certified for joint use. The SUT met the critical interoperability requirements for a Strategic Network Element set forth in appendices 5 and 9 of reference (c) using test procedures derived from reference (d). No other configurations, features, or functions, except those cited within this report, are certified by the JITC or authorized by the Program Management Office for use within the DSN. This certification expires upon changes that affect interoperability, but no later than three years from the date of this memorandum.

3. This certification is based on interoperability testing and review of the vendor's Letters of Compliance (LoC). Interoperability testing was conducted by JITC at the Global Information Grid Network Test Facility, Fort Huachuca, Arizona from 15 October through 2 November 2007. Review of the vendor's LoC was completed on 20 November 2007. The Certification Testing Summary (enclosure 2) documents the test results and describes the test network. Users should verify interoperability before deploying the SUT in an environment that varies significantly from that described.

4. The SUT Interoperability Test Summary is shown in table 1 and the Capability and Feature Requirements used to evaluate the interoperability of the SUT are indicated in table 2.

Table 1. SUT Interoperability Test Summary

DSN Access Interfaces			
Interface & Signaling	**Critical**	**Status**	**Remarks**
T1 CAS (AMI/SF) DTMF, DP, MFR1	No[1]	Certified	Met all CRs and FRs.
T1 CAS (B8ZS/ESF) DTMF, DP, MFR1	No[1]	Certified	Met all CRs and FRs.
T1 PRI (ANSI T1.619a)	No[1]	Certified	Met all CRs and FRs.
T1 SS7 (ANSI T1.619a)	No[1]	Certified	Met all CRs and FRs.
E1 CAS (HDB3) DTMF, MFR1, DP	No[1] (Europe only)	Not Tested	The SUT offers this; however, it was not tested. There is no operational impact because it is not a critical requirement for a Strategic Network Element.
E1 ISDN PRI (ITU-T Q.955.3)	No[1] (Europe only)	Not Tested	The SUT offers this; however, it was not tested. There is no operational impact because it is not a critical requirement for a Strategic Network Element.
E1 SS7 (ANSI T1.619a)	No[1] (Europe only)	Not Tested	The SUT offers this; however, it was not tested. There is no operational impact because it is not a critical requirement for a Strategic Network Element.
DS3	No[1]	Certified	Met all CRs and FRs.
10/100 Mbps Ethernet	No[1]	Certified	Met all CRs and FRs.
Gigabit Ethernet	No[1]	Certified	Met all CRs and FRs.
10 Gigabit Ethernet	No[1]	Certified	Met all CRs and FRs.

DSN Transport Interfaces				
Optical Carrier Level	**Transport Level**	**Critical**	**Status**	**Remarks**
OC-3	VT1.5	No[2]	Certified	Met all CRs and FRs.
	STS-1	No[2]	Certified	Met all CRs and FRs.
OC-12	VT1.5	No[2]	Certified	Met all CRs and FRs.
	STS-1	No[2]	Certified	Met all CRs and FRs.
OC-48	VT1.5	No[2]	Certified	Met all CRs and FRs.
	STS-1	No[2]	Certified	Met all CRs and FRs.
OC-192	VT1.5	No[2]	Certified	Met all CRs and FRs.
	STS-1	No[2]	Certified	Met all CRs and FRs.
DWDM	2.5 Gigabit Channel	No[2]	Certified	Met all CRs and FRs.
	10 Gigabit Channel	No[2]	Certified	Met all CRs and FRs.

Features And Capabilities			
Features and Capabilities	**Critical**	**Status**	**Remarks**
Synchronization	Yes	Certified	Met all CRs and FRs.
Network Management	Yes	Certified	Met all CRs and FRs.
Security	Yes	See note 3.	See note 3.

LEGEND:

AMI	- Alternate Mark Inversion
ANSI	- American National Standards Institute
B8ZS	- Bipolar Eight Zero Substitution
CAS	- Channel Associated Signaling
CRs	- Capability Requirements
DISA	- Defense Information Systems Agency
DP	- Dial Pulse
DS3	- Digital Signal Level 3 (44.736 Mbps)
DSN	- Defense Switched Network
DTMF	- Dual Tone Multi-Frequency
DWDM	- Dense Wavelength Division Multiplexing
E1	- European Basic Multiplex Rate (2.048 Mbps)
ESF	- Extended Super Frame
FRs	- Feature Requirements
Gbps	- Gigabits per second
GSCR	- Generic Switching Center Requirements
HDB3	- High Density Bipolar 3
ISDN	- Integrated Services Digital Network
ITU-T	- International Telecommunication Union – Telecommunication Standardization Sector
Mbps	- Megabits per second
MFR1	- Multi-frequency Recommendation 1
MLPP	- Multi-Level Precedence and Preemption
OC-3	- Optical Carrier Level 3 (155 Mbps)
OC-12	- Optical Carrier Level 12 (622 Mbps)
OC-48	- Optical Carrier Level 48 (2.448 Gbps)
OC-192	- Optical Carrier Level 192 (10 Gbps)
PRI	- Primary Rate Interface
Q.955.3	- ISDN Signaling Standard for E1 MLPP
SF	- Super Frame
SS7	- Signaling System 7
SUT	- System Under Test
STS	- Synchronous Transport Signal
T1	- Digital Transmission Link Level 1 (1.544 Mbps)
T1.619a	- SS7 and ISDN MLPP Signaling Standard for T1
VT1.5	- Virtual Tributary

NOTES:

1 The GSCR does not stipulate a minimum Access interface requirement for a Strategic Network Element.
2 The GSCR does not stipulate a minimum Transport interface requirement for a Strategic Network Element.
3 Information assurance testing is accomplished via DISA-led Information Assurance test teams and published in a separate report.

Table 2. SUT Capability and Feature Interoperability Requirements

DSN Access Interfaces			
Interface	**Critical**	**Requirements Required or Conditional**	**References**
T1 CAS	No[1]		
T1 SS7 (ANSI T1.619a)	No[1]	• DS1 Interface Characteristics (C) • DS1 Supervisory Channel Associated Signaling (C)	• GSCR para. A9.5.1.2.4 • GSCR para. A9.5.1.2.4
T1 ISDN PRI (ANSI T1.607/ANSI T1.619a)	No[1]	• DS1 Clear Channel Capability (C) • DS1 Alarm and Restoral Requirements (C)	• GSCR para. A9.5.1.2.4 • GSCR para. A9.5.1.2.4
E1 ISDN PRI (ITU-T Q.955.3)	No[1] (Europe only)	• E1 Interface Characteristics (C) • E1 Supervisory Channel Associated Signaling (C)	• GSCR para. A9.5.1.2.5 • GSCR para. A9.5.1.2.5
E1 CAS	No[1] (Europe only)	• E1 Clear Channel Capability (C) • E1 Alarm and Restoral Requirements (C)	• GSCR para. A9.5.1.2.5 • GSCR para. A9.5.1.2.5
E1 SS7 (ANSI T1.619a)	No[1] (Europe only)	• MOS (R) • BERT (R) • Secure Transmission (Voice and Data) (R)	• GSCR para. A9.5.1.1 • GSCR para. A9.5.1.1 • GSCR para. A9.5.1.1
DS3	No[1]	• Modem (R) • Facsimile (R) • Call Control Signals (R)	• GSCR para. A9.5.1.1 • GSCR para. A9.5.1.1 • GSCR para. A9.5.1.1
10/100 Mbps Ethernet	No[1]	• Call Congestion (R) • Voice Compression (C)	• GSCR para. A9.5.1.1 • GSCR para. A9.5.1.1.4
Gigabit Ethernet	No[1]	• DS3 Interface Requirements (R) • IP Interface (C)	• GSCR para. A9.5.1.2.6 • GSCR para. A9.5.1.2.9
10 Gigabit Ethernet	No[1]		
DSN Transport Interfaces			
Interface	**Critical**	**Requirements Required or Conditional**	**References**
OC-3	No[2]	• MLPP (R) • GR-303-CORE (R) • GR-253-CORE (R) • GR-782-CORE (R) • ANSI T1.105-2001 (R) • DS1 Rate Transport via VT1.5 (R) • DS1 Rate Provisioning (R)	• GSCR para. A5.5.1 • GSCR para. A5.5.2 • GSCR para. A5.5.2 • GSCR para. A5.5.2 • GSCR para. A5.5.2 • GSCR para. A5.5.2 • GSCR para. A5.5.2
OC-12	No[2]	• DS0 Call Processing (R) • DS0 to OC-3 Route Assignment (R) • Facility Alarms (R) • DS1 AIS/Yellow (R) • DS0 AIS/DS0 RAI (R)	• GSCR para. A5.5.2 • GSCR para. A5.5.3 • GSCR para. A5.5.4 • GSCR para. A5.5.4 • GSCR para. A5.5.4
OC-48	No[2]	• Synchronization in accordance with GR-518-CORE (R) • Synchronization in accordance with GR-253-CORE (R) • Synchronization in accordance with GR-436-CORE (R) • Reliability (R) • Security (R)	• GSCR para. A5.5.5 • GSCR para. A5.5.5 • GSCR para. A5.5.5 • GSCR para. A5.5.6 • GSCR para. A5.6
OC-192	No[2]	• MOS (R) • BERT (R) • Secure Transmission (Voice and Data) (R) • Modem (R) • Facsimile (R)	• GSCR para. A9.5.1.1 • GSCR para. A9.5.1.1 • GSCR para. A9.5.1.1 • GSCR para. A9.5.1.1 • GSCR para. A9.5.1.1
DWDM	No[2]	• Call Control Signals (R) • Call Congestion (R) • Voice Compression (C)	• GSCR para. A9.5.1.1 • GSCR para. A9.5.1.1 • GSCR para. A9.5.1.1.4

Table 2. SUT Capability and Feature Interoperability Requirements (continued)

SUT Features And Capabilities			
Feature/Capability	**Critical**	**Requirements Required or Conditional**	**References**
Synchronization	Yes	• Timing (R)	• GSCR para. A9.5.1.2.7
Network Management	Yes	• Management Option (R) - Local Management (Front Panel and/or External Console) (C) - ADIMSS (C) • Fault Management (C) • Loop Back Capability (C) • Operational Configuration Restoral (R)	• GSCR para. A9.5.2.1 • GSCR para. A9.5.2.2 • GSCR para. A9.5.2.3 • GSCR para. A9.5.3
Security	Yes	• DIACAP (replacement for DITSCAP) (R)	• GSCR para. A9.6

LEGEND:

A	- Appendix	IP	- Internet Protocol
ADIMSS	- Advanced DSN Intergraded Management Support System	ISDN	- Integrated Services Digital Network
ANSI	- American National Standards Institute	ITU-T	- International Telecommunication Union - Telecommunication Standardization Sector
AIS	- Alarm Indication Signal		
BERT	- Bit Error Ratio Test	LSSGR	- Local Access and Transport Area (LATA) Switching Systems Generic Requirements
C	- Conditional		
CAS	- Channel Associated Signaling	Mbps	- Megabits per second
DIACAP	- DoD Information Assurance Certification and Accreditation Process	MLPP	- Multi-Level Precedence and Preemption
DITSCAP	- DoD Information Technology Security Certification and Accreditation Process	MOS	- Mean Opinion Score
		OC-3	- Optical Carrier Level 3 (155 Mbps)
DoD	- Department of Defense	OC-12	- Optical Carrier Level 12 (622 Mbps)
DS0	- Digital Signal Level 0	OC-48	- Optical Carrier Level 48 (2.448 Gbps)
DS1	- Digital Signal Level 1	OC-192	- Optical Carrier Level 192 (10 Gbps)
DS3	- Digital Signal Level 3	Para	- paragraph
DSN	- Defense Switched Network	PRI	- Primary Rate Interface
DSS1	- Digital Subscriber Signaling 1	Q.955.3	- ISDN Signaling standard for E1 MLPP
DWDM	- Dense Wavelength Division Multiplexing	R	- Required
E1	- European Basic Multiplex Rate (2.048 Mbps)	RAI	- Remote Alarm Indication
Gbps	- Gigabits per second	SONET	- Synchronous Optical Network
GR	- Generic Requirement	SS7	- Signaling System 7
GR-253-CORE	- SONET Transport Systems: Common Generic Criteria	SUT	- System Under Test
GR-303-CORE	- Integrated Digital Loop Carrier System Generic Requirements, Objectives, and Interface	T1	- Digital Transmission Link Level 1 (1.544 Mbps)
		T1.105-2001	- SONET – Basic Description include Multiplexer structure, rates, formats
GR-436-CORE	- Digital Network Synchronization Plan	T1.607	- ISDN – Layer 3 Signaling Specification for Circuit Switched Bearer Service for DSS1
GR-518-CORE	- LSSGR: Synchronization, Section 18		
GR-782-CORE	- SONET Digital Switch Trunk Interface Criteria	T1.619a	- SS7 and ISDN MLPP Signaling Standard for T1
GSCR	- Generic Switching Center Requirement	VT1.5	- Virtual Tributary 1.5

NOTES:
1 The GSCR does not stipulate a minimum Access interface requirement for a Strategic Network Element.
2 The GSCR does not stipulate a minimum Transport interface requirement for a Strategic Network Element.

5. No detailed test report was developed in accordance with the Program Manager's request. JITC distributes interoperability information via the JITC Electronic Report Distribution (ERD) system, which uses Unclassified-But-Sensitive Internet Protocol Router Network (NIPRNet) e-mail. More comprehensive interoperability status information is available via the JITC System Tracking Program (STP). The STP is accessible by .mil/gov users on the NIPRNet at https://stp.fhu.disa.mil. Test reports, lessons learned, and related testing documents and references are on the JITC Joint Interoperability Tool (JIT) at http://jit.fhu.disa.mil (NIPRNet), or http://199.208.204.125 (SIPRNet). Information related to DSN testing is on the Telecom Switched Services Interoperability (TSSI) website at http://jitc.fhu.disa.mil/tssi.

6. The JITC point of contact is Mr. Edward Mellon, DSN 879-5159, commercial (520) 538-5159, FAX DSN 879-4347, or e-mail to Edward.mellon@disa.mil. The tracking number for the SUT is 0709303.

FOR THE COMMANDER:

2 Enclosures a/s

RICHARD A. MEADOR
Chief
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Defense Information Systems Agency, Net-Centricity Requirements and Assessment Branch, ATTN: GE333, Room 244, P.O. Box 4502, Falls Church, VA 22204-4502
Office of Chief of Naval Operations (N71CC2), CNO N6/N7, 2000 Navy Pentagon, Washington, DC 20350
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Department of the Army, Office of the Secretary of the Army, CIO/G6, ATTN: SAIS-IOQ, 107 Army Pentagon, Washington, DC 20310-0107
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National Security Agency, ATTN: DT, Suite 6496, 9800 Savage Road, Fort Meade, MD 20755-6496
Director, Defense Information Systems Agency, ATTN: GS235, Room 5W24-8A, P.O. Box 4502, Falls Church, VA 22204-4502
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U.S. Joint Forces Command, J68, Net-Centric Integration, Communications, and Capabilities Division, 1562 Mitscher Ave., Norfolk, VA 23551-2488
Defense Information Systems Agency (DISA), ATTN: GS23 (Mr. McLaughlin), Room 5W23, 5275 Leesburg Pike (RTE 7), Falls Church, VA 22041

ADDITIONAL REFERENCES

(c) Defense Information Systems Agency, "Department of Defense Voice Networks Generic Switching Center Requirements (GSCR), Errata Change 2," 14 December 2006, Revised 27 March 2007

(d) Joint Interoperability Test Command, "Defense Switched Network Generic Switch Test Plan (GSTP), Change 2," 2 October 2006

CERTIFICATION TESTING SUMMARY

1. SYSTEM TITLE. Cisco Optical Network System (ONS) 15454 with Software Release 8.0.0 (08.00-007A-27.16), hereinafter referred to as the System Under Test (SUT).

2. PROPONENTS. Defense Information Systems Agency (DISA).

3. PROGRAM MANAGER. Mr. Anthony Mazzuchi, MSPP Service Manager, GS222, 5275 Leesburg, Pike Falls Church, Virginia 22042, e-mail: Anthony.Mazzuchi@disa.mil.

4. TESTER. Joint Interoperability Test Command (JITC), Fort Huachuca, Arizona.

5. SYSTEM UNDER TEST DESCRIPTION. The SUT includes expandable, managed systems, which are deployed as Strategic Network Elements. These systems are controlled by the Cisco Transport Controller (CTC) using either the Java Runtime Environment (JRE) or standalone Cisco Transport Manager (CTM) client software and support a number of existing fiber optic and electrical applications. The SUT is managed from a remote client, which can be used to manage multiple units. The SUT provides the functions of multiple network elements in a single platform.

The SUT can be configured in the following two platforms: the Synchronous Optical Network (SONET)/Synchronous Digital Hierarchy (SDH) Multiservice Provisioning Platform (MSPP) and the Multiservice Transport Platform (MSTP). SONET and SDH are transport technologies, SONET is predominantly used in the United States and SDH is predominantly used overseas. Both the SONET/SDH MSPP and the MSTP platform configurations were tested and are covered under this certification.

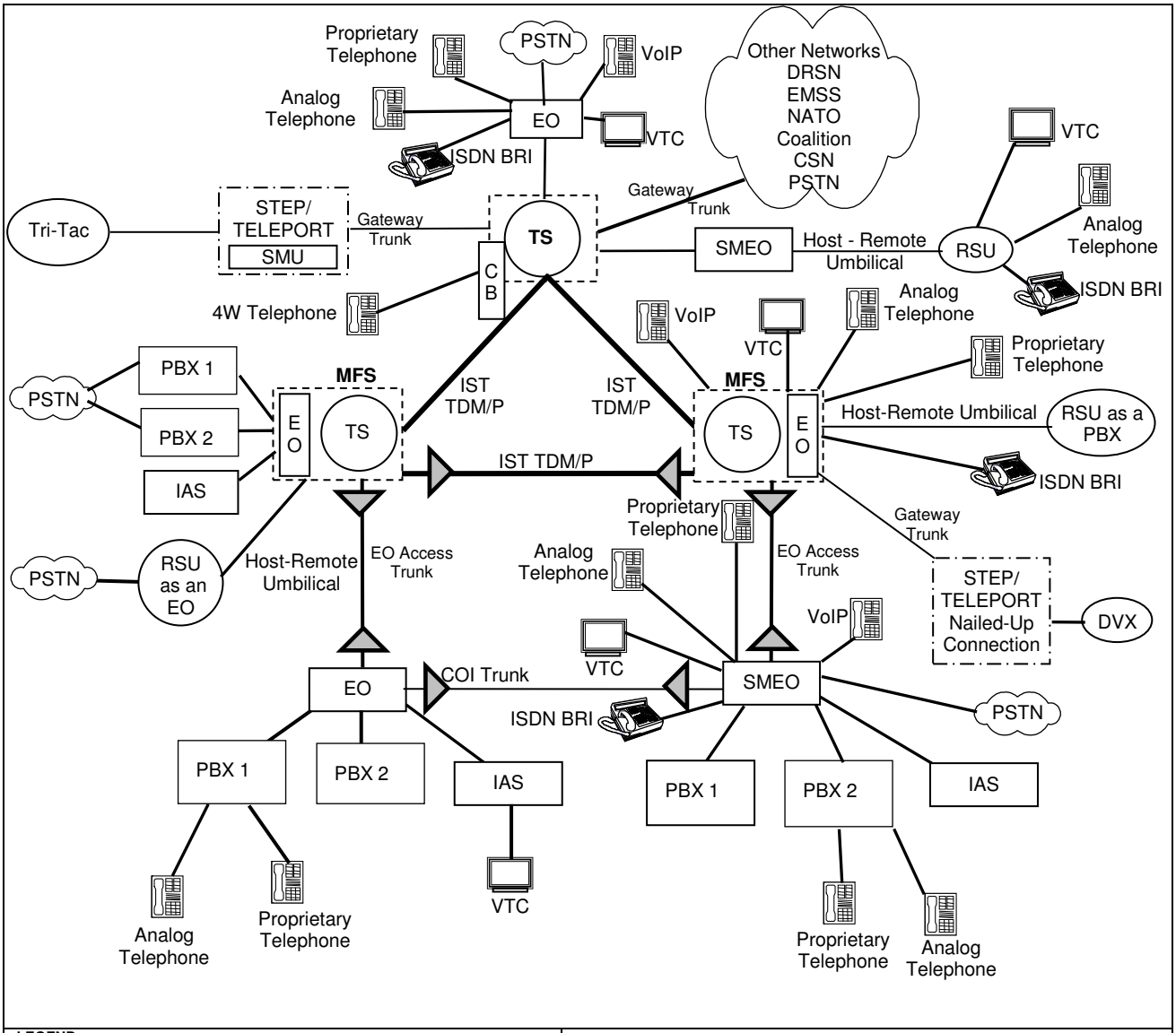
The SUT SONET/SDH platform is configured with universal expansion slots for adding Digital Signal Level 1 (DS1), Digital Signal Level 3 (DS3), 10/100 Megabytes per second (Mbps) Ethernet, Gigabit Ethernet, DS3/Virtual Tributary (VT) Transmux, Synchronous Transport Signal -1 (STS-1), Optical Carrier Level 3 (OC-3), Optical Carrier Level 12 (OC-12), Optical Carrier Level 48 (OC-48), Optical Carrier Level 192 (OC-192), and Dense Wavelength Division Multiplexing (DWDM). The SONET/SDH platform supports limited DWDM capabilities. The DS1 interface can be supplied remotely via fiber-optic cable connecting the SUT to the DS1 Service Module.

The 15454 MSTP is based on the 15454 MSPP chassis. It expands the DWDM capabilities of the 15454 platform and when used as a purely DWDM transport platform, it takes on a new role as an MSTP. The MSTP supports 10 Gigabit Ethernet.

The SUT is managed via the CTC application. CTC is a JRE application that is stored on a card internal to the chassis. The workstation with the CTC application served as a management console, and it managed all nodes in the test network via in-band management. A Sun server with CTM server software was used for management of the SUT. A laptop with Secure Socket Shell software was used to tunnel into the server to

locally run the CTM client application. All management and real-time visibility functions are available via this client. The client includes a visual representation of all SUT system hardware and each monitored circuit.

6. OPERATIONAL ARCHITECTURE. The Generic Switching Center Requirements (GSCR) Defense Switched Network (DSN) operational architecture is depicted in figure 2-1.



LEGEND:

4W	- 4-Wire
BRI	- Basic Rate Interface
CB	- Channel Bank
COI	- Community of Interest
CSN	- Canadian Switch Network
DRSN	- Defense Red Switch Network
DSN	- Defense Switched Network
DVX	- Deployable Voice Exchange
EMSS	- Enhanced Mobile Satellite System
EO	- End Office
IAS	- Integrated Access Switch
ISDN	- Integrated Services Digital Network
IST	- Interswitch Trunk
MFS	- Multifunction Switch
NATO	- North Atlantic Treaty Organization

PBX	- Private Branch Exchange
PBX 1	- Private Branch Exchange 1
PBX 2	- Private Branch Exchange 2
PSTN	- Public Switched Telephone Network
RSU	- Remote Switching Unit
SMEO	- Small End Office
SMU	- Switched Multiplex Unit
STEP	- Standardized Tactical Entry Point
SUT	- System Under Test
TDM/P	- Time Division Multiplex/Packetized
Tri-Tac	- Tri-Service Tactical Communications Program
TS	- Tandem Switch
VoIP	- Voice over Internet Protocol
VTC	- Video Teleconferencing
△	- SUT

Figure 2-1. DSN Architecture

7. REQUIRED SYSTEM INTERFACES. The SUT Interoperability Test Summary is shown in table 2-1 and the Capability and Feature Requirements used to evaluate the interoperability of the SUT are indicated in table 2-2.

Table 2-1. SUT Interoperability Test Summary

DSN Access Interfaces			
Interface & Signaling	**Critical**	**Status**	**Remarks**
T1 CAS (AMI/SF) DTMF, DP, MFR1	No[1]	Certified	Met all CRs and FRs.
T1 CAS (B8ZS/ESF) DTMF, DP, MFR1	No[1]	Certified	Met all CRs and FRs.
T1 PRI (ANSI T1.619a)	No[1]	Certified	Met all CRs and FRs.
T1 SS7 (ANSI T1.619a)	No[1]	Certified	Met all CRs and FRs.
E1 CAS (HDB3) DTMF, MFR1, DP	No[1] (Europe only)	Not Tested	The SUT offers this; however, it was not tested. There is no operational impact because it is not a critical requirement for a Strategic Network Element.
E1 ISDN PRI (ITU-T Q.955.3)	No[1] (Europe only)	Not Tested	The SUT offers this; however, it was not tested. There is no operational impact because it is not a critical requirement for a Strategic Network Element.
E1 SS7 (ANSI T1.619a)	No[1] (Europe only)	Not Tested	The SUT offers this; however, it was not tested. There is no operational impact because it is not a critical requirement for a Strategic Network Element.
DS3	No[1]	Certified	Met all CRs and FRs.
10/100 Mbps Ethernet	No[1]	Certified	Met all CRs and FRs.
Gigabit Ethernet	No[1]	Certified	Met all CRs and FRs.
10 Gigabit Ethernet	No[1]	Certified	Met all CRs and FRs.

DSN Transport Interfaces				
Optical Carrier Level	**Transport Level**	**Critical**	**Status**	**Remarks**
OC-3	VT1.5	No[2]	Certified	Met all CRs and FRs.
	STS-1	No[2]	Certified	Met all CRs and FRs.
OC-12	VT1.5	No[2]	Certified	Met all CRs and FRs.
	STS-1	No[2]	Certified	Met all CRs and FRs.
OC-48	VT1.5	No[2]	Certified	Met all CRs and FRs.
	STS-1	No[2]	Certified	Met all CRs and FRs.
OC-192	VT1.5	No[2]	Certified	Met all CRs and FRs.
	STS-1	No[2]	Certified	Met all CRs and FRs.
DWDM	2.5 Gigabit Channel	No[2]	Certified	Met all CRs and FRs.
	10 Gigabit Channel	No[2]	Certified	Met all CRs and FRs.

Features And Capabilities			
Features and Capabilities	**Critical**	**Status**	**Remarks**
Synchronization	Yes	Certified	Met all CRs and FRs.
Network Management	Yes	Certified	Met all CRs and FRs.
Security	Yes	See note 3.	See note 3.

LEGEND:

AMI	- Alternate Mark Inversion	ITU-T	- International Telecommunication Union – Telecommunication Standardization Sector
ANSI	- American National Standards Institute	Mbps	- Megabits per second
B8ZS	- Bipolar Eight Zero Substitution	MFR1	- Multi-frequency Recommendation 1
CAS	- Channel Associated Signaling	MLPP	- Multi-Level Precedence and Preemption
CRs	- Capability Requirements	OC-3	- Optical Carrier Level 3 (155 Mbps)
DISA	- Defense Information Systems Agency	OC-12	- Optical Carrier Level 12 (622 Mbps)
DP	- Dial Pulse	OC-48	- Optical Carrier Level 48 (2.448 Gbps)
DS3	- Digital Signal Level 3 (44.736 Mbps)	OC-192	- Optical Carrier Level 192 (10 Gbps)
DSN	- Defense Switched Network	PRI	- Primary Rate Interface
DTMF	- Dual Tone Multi-Frequency	Q.955.3	- ISDN Signaling Standard for E1 MLPP
DWDM	- Dense Wavelength Division Multiplexing	SF	- Super Frame
E1	- European Basic Multiplex Rate (2.048 Mbps)	SS7	- Signaling System 7
ESF	- Extended Super Frame	SUT	- System Under Test
FRs	- Feature Requirements	STS	- Synchronous Transport Signal
Gbps	- Gigabits per second	T1	- Digital Transmission Link Level 1 (1.544 Mbps)
GSCR	- Generic Switching Center Requirements	T1.619a	- SS7 and ISDN MLPP Signaling Standard for T1
HDB3	- High Density Bipolar 3	VT1.5	- Virtual Tributary
ISDN	- Integrated Services Digital Network		

NOTES:

1 The GSCR does not stipulate a minimum Access interface requirement for a Strategic Network Element.

2 The GSCR does not stipulate a minimum Transport interface requirement for a Strategic Network Element.

3 Information assurance testing is accomplished via DISA-led Information Assurance test teams and published in a separate report.

Table 2-2. SUT Capability and Feature Interoperability Requirements

DSN Access Interfaces			
Interface	**Critical**	**Requirements Required or Conditional**	**References**
T1 CAS	No[1]		
T1 SS7 (ANSI T1.619a)	No[1]	• DS1 Interface Characteristics (C) • DS1 Supervisory Channel Associated Signaling (C)	• GSCR para. A9.5.1.2.4 • GSCR para. A9.5.1.2.4
T1 ISDN PRI (ANSI T1.607/ANSI T1.619a)	No[1]	• DS1 Clear Channel Capability (C) • DS1 Alarm and Restoral Requirements (C) • E1 Interface Characteristics (C)	• GSCR para. A9.5.1.2.4 • GSCR para. A9.5.1.2.4 • GSCR para. A9.5.1.2.5
E1 ISDN PRI (ITU-T Q.955.3)	No[1] (Europe only)	• E1 Supervisory Channel Associated Signaling (C) • E1 Clear Channel Capability (C) • E1 Alarm and Restoral Requirements (C)	• GSCR para. A9.5.1.2.5 • GSCR para. A9.5.1.2.5 • GSCR para. A9.5.1.2.5
E1 CAS	No[1] (Europe only)	• MOS (R) • BERT (R)	• GSCR para. A9.5.1.1 • GSCR para. A9.5.1.1
E1 SS7 (ANSI T1.619a)	No[1] (Europe only)	• Secure Transmission (Voice and Data) (R) • Modem (R)	• GSCR para. A9.5.1.1 • GSCR para. A9.5.1.1
DS3	No[1]	• Facsimile (R) • Call Control Signals (R)	• GSCR para. A9.5.1.1 • GSCR para. A9.5.1.1
10/100 Mbps Ethernet	No[1]	• Call Congestion (R) • Voice Compression (C)	• GSCR para. A9.5.1.1 • GSCR para. A9.5.1.1.4
Gigabit Ethernet	No[1]	• DS3 Interface Requirements (R) • IP Interface (C)	• GSCR para. A9.5.1.2.6 • GSCR para. A9.5.1.2.9
10 Gigabit Ethernet	No[1]		
DSN Transport Interfaces			
Interface	**Critical**	**Requirements Required or Conditional**	**References**
OC-3	No[2]	• MLPP (R) • GR-303-CORE (R) • GR-253-CORE (R) • GR-782-CORE (R) • ANSI T1.105-2001 (R) • DS1 Rate Transport via VT1.5 (R) • DS1 Rate Provisioning (R)	• GSCR para. A5.5.1 • GSCR para. A5.5.2 • GSCR para. A5.5.2 • GSCR para. A5.5.2 • GSCR para. A5.5.2 • GSCR para. A5.5.2 • GSCR para. A5.5.2
OC-12	No[2]	• DS0 Call Processing (R) • DS0 to OC-3 Route Assignment (R) • Facility Alarms (R) • DS1 AIS/Yellow (R) • DS0 AIS/DS0 RAI (R)	• GSCR para. A5.5.2 • GSCR para. A5.5.3 • GSCR para. A5.5.4 • GSCR para. A5.5.4 • GSCR para. A5.5.4
OC-48	No[2]	• Synchronization in accordance with GR-518-CORE (R) • Synchronization in accordance with GR-253-CORE (R) • Synchronization in accordance with GR-436-CORE (R) • Reliability (R) • Security (R)	• GSCR para. A5.5.5 • GSCR para. A5.5.5 • GSCR para. A5.5.5 • GSCR para. A5.5.6 • GSCR para. A5.6
OC-192	No[2]	• MOS (R) • BERT (R) • Secure Transmission (Voice and Data) (R) • Modem (R) • Facsimile (R)	• GSCR para. A9.5.1.1 • GSCR para. A9.5.1.1 • GSCR para. A9.5.1.1 • GSCR para. A9.5.1.1 • GSCR para. A9.5.1.1
DWDM	No[2]	• Call Control Signals (R) • Call Congestion (R) • Voice Compression (C)	• GSCR para. A9.5.1.1 • GSCR para. A9.5.1.1 • GSCR para. A9.5.1.1.4

Table 2-2. SUT Capability and Feature Interoperability Requirements (continued)

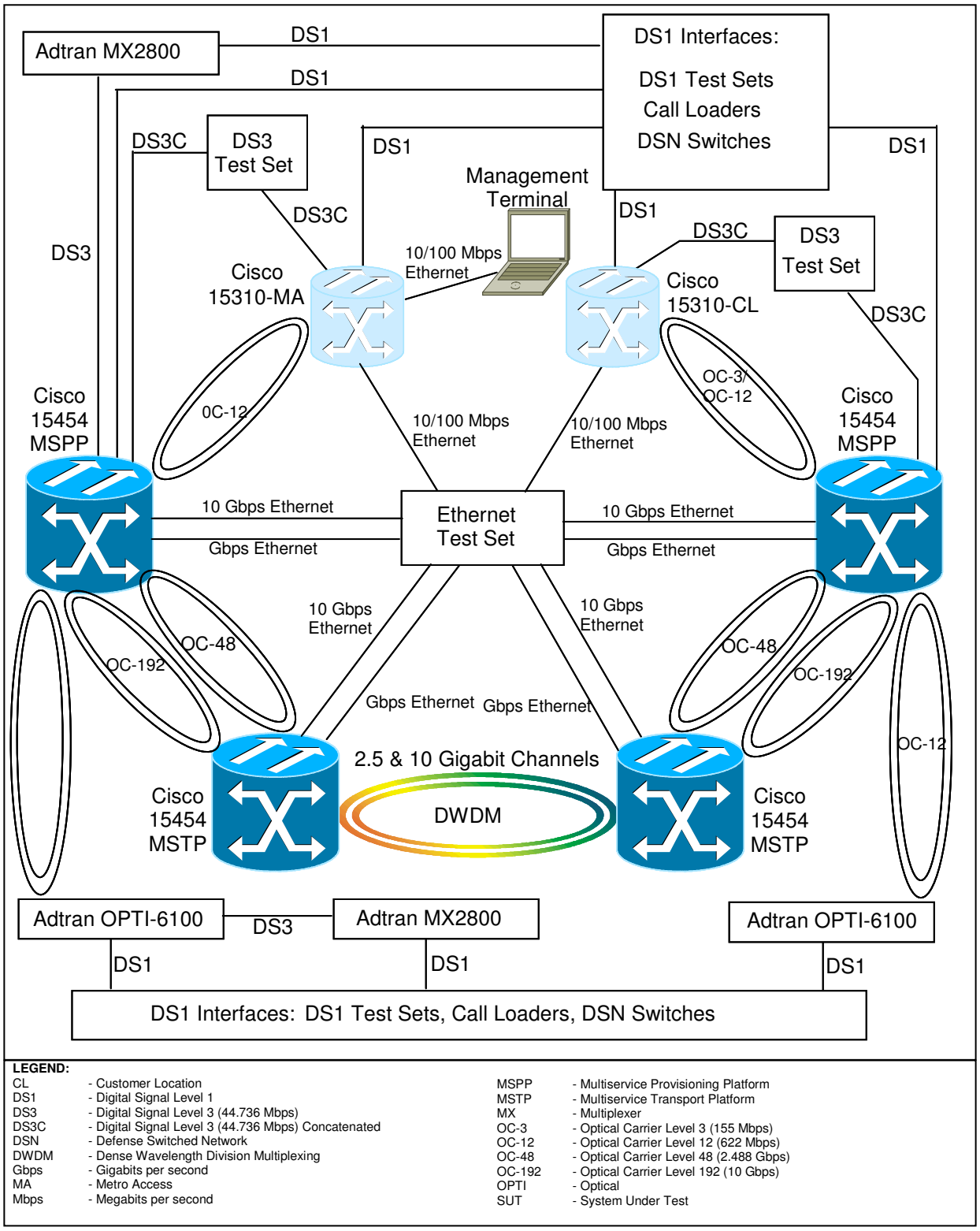
SUT Features And Capabilities			
Feature/Capability	**Critical**	**Requirements Required or Conditional**	**References**
Synchronization	Yes	• Timing (R)	• GSCR para. A9.5.1.2.7
Network Management	Yes	• Management Option (R) - Local Management (Front Panel and/or External Console) (C) - ADIMSS (C) • Fault Management (C) • Loop Back Capability (C) • Operational Configuration Restoral (R)	• GSCR para. A9.5.2.1 • GSCR para. A9.5.2.2 • GSCR para. A9.5.2.3 • GSCR para. A9.5.3
Security	Yes	• DIACAP (replacement for DITSCAP) (R)	• GSCR para. A9.6

LEGEND:

A	- Appendix
ADIMSS	- Advanced DSN Intergraded Management Support System
ANSI	- American National Standards Institute
AIS	- Alarm Indication Signal
BERT	- Bit Error Ratio Test
C	- Conditional
CAS	- Channel Associated Signaling
DIACAP	- DoD Information Assurance Certification and Accreditation Process
DITSCAP	- Department of Defense Information Technology Security Certification and Accreditation Process
DS0	- Digital Signal Level 0
DS1	- Digital Signal Level 1
DS3	- Digital Signal Level 3
DSN	- Defense Switched Network
DSS1	- Digital Subscriber Signaling 1
DWDM	- Dense Wavelength Division Multiplexing
E1	- European Basic Multiplex Rate (2.048 Mbps)
Gbps	- Gigabits per second
GR	- Generic Requirement
GR-253-CORE	- SONET Transport Systems: Common Generic Criteria
GR-303-CORE	- Integrated Digital Loop Carrier System Generic Requirements, Objectives, and Interface
GR-436-CORE	- Digital Network Synchronization Plan
GR-518-CORE	- LSSGR: Synchronization, Section 18
GR-782-CORE	- SONET Digital Switch Trunk Interface Criteria
GSCR	- Generic Switching Center Requirement
IP	- Internet Protocol
ISDN	- Integrated Services Digital Network
ITU-T	- International Telecommunication Union - Telecommunication Standardization Sector
LSSGR	- Local Access and Transport Area (LATA) Switching Systems Generic Requirements
Mbps	- Megabits per second
MLPP	- Multi-Level Precedence and Preemption
MOS	- Mean Opinion Score
OC-3	- Optical Carrier Level 3 (155 Mbps)
OC-12	- Optical Carrier Level 12 (622 Mbps)
OC-48	- Optical Carrier Level 48 (2.448 Gbps)
OC-192	- Optical Carrier Level 192 (10 Gbps)
PRI	- Primary Rate Interface
Q.955.3	- ISDN Signaling standard for E1 MLPP
R	- Required
RAI	- Remote Alarm Indication
SONET	- Synchronous Optical Network
SS7	- Signaling System 7
SUT	- System Under Test
T1	- Digital Transmission Link Level 1 (1.544 Mbps)
T1.105-2001	- SONET – Basic Description include Multiplexer structure, rates, formats
T1.607	- ISDN – Layer 3 Signaling Specification for Circuit Switched Bearer Service for DSS1
T1.619a	- SS7 and ISDN MLPP Signaling Standard for T1
VT1.5	- Virtual Tributary 1.5

NOTES:
1 The GSCR does not stipulate a minimum Access interface requirement.
2 The GSCR does not stipulate a minimum Transport interface requirement.

8. TEST NETWORK DESCRIPTION. The SUT was tested at JITC's Global Information Grid Network Test Facility in a manner and configuration similar to that of the DSN operational environment. This test was conducted using the test configuration shown in figure 2-2.



LEGEND:

CL	- Customer Location
DS1	- Digital Signal Level 1
DS3	- Digital Signal Level 3 (44.736 Mbps)
DS3C	- Digital Signal Level 3 (44.736 Mbps) Concatenated
DSN	- Defense Switched Network
DWDM	- Dense Wavelength Division Multiplexing
Gbps	- Gigabits per second
MA	- Metro Access
Mbps	- Megabits per second
MSPP	- Multiservice Provisioning Platform
MSTP	- Multiservice Transport Platform
MX	- Multiplexer
OC-3	- Optical Carrier Level 3 (155 Mbps)
OC-12	- Optical Carrier Level 12 (622 Mbps)
OC-48	- Optical Carrier Level 48 (2.488 Gbps)
OC-192	- Optical Carrier Level 192 (10 Gbps)
OPTI	- Optical
SUT	- System Under Test

Figure 2-2. SUT Test Configuration

9. SYSTEM CONFIGURATIONS. Table 2-3 provides the system configurations, hardware and software components tested with the SUT. The SUT was tested in an operationally realistic environment to determine interoperability with a complement of DSN switches noted in table 2-3. The DSN switches listed in table 2-3 only depict the tested configuration. Table 2-3 is not intended to identify the only switches that are certified with the SUT. The SUT is certified with switching systems listed on the DSN Approved Products List (APL) that offer the same certified interfaces.

Table 2-3. Tested System Configurations

System Name	Software Release
Nortel CS2100	Succession Enterprise (SE)08
Siemens EWSD	19d with Patch Set 46
Alcatel-Lucent 5ESS	5E16.2 Broadcast Warning Message (BWM) 07-0003
Avaya S8710	Communication Manager (CM) 4.0 (R014x.00.2.731.7: Super Patch 14419)
Nortel CS1000M Single Group	4.5W
Adtran OPTI-6100 (NE)	R3.3
Adtran 2800MX (NE)	Code Version 3.20A
Cisco ONS 15310-MA	8.0.0 (08.00-007A-27.16)
Cisco ONS 15310-CL	8.0.0 (08.00-007A-27.16)

System		Card	Description
SUT With software release 8.0.0 (08.00-007A-27.16)	ONS 15454 Chassis: The cards listed are interchangeable for the MSPP and MSTP configurations.	15454-DS1E1-56 (MSPP)	DS1/ E1, 1:N, 56 ports, I-Temp
		CE-100T-8 (MSPP)	8x10/100T Carrier Ethernet
		MRC-I-12 (MSPP)	OC3/12/48, 12 ports, IOF
		XC-VXC-10G (MSPP)	Cross-Connect Module, High Cap. Tributary
		DS3XM-12 (MSPP)	DS3, Transmux, 12 Ckt, I-Temp
		DS3EC1-48 (MSPP)	DS3, 48 Ckt., reqs SA-HD shelf assembly
		MRC-2.5G4 (MSPP)	OC3/12/48, 2.5G Max, 4 ports, IOF
		ML-1000-2 (MSPP)	Gigabit Ethernet, 2 Ckt, L2/L3, SFP
		CE-1000-4 (MSPP)	4 port GE Carrier Edge card
		AIC-I (MSPP)	Alarm Interface Card Enh Intl, I-Temp
		10G-SI (MSPP)	10G, SR, Includes SR XFP (ONS-XC-10G-S1)
		TCC2P-K9 (MSPP/MSTP)	Timing Communications Control Two Plus, I-Temp
		OPT-AMP-17-C (MSTP)	17dB Gain, Amp
		40 WSS-C (MSTP)	40Chs Wavelength Selective Switch - C-band - Odd
		40 DMX-C (MSTP)	40Chs Demultiplexer - C-band - Odd
		MS-ISC-100T (MSTP)	MultiShelf Management Integrated Switch Card
		OSCM (MSTP)	ONS 15454 Optical Service Channel Module
		10GE-XP (MSTP)	Ethernet 4-10GE Crossponder
		GE-XP (MSTP)	Ethernet 20-GE / 2-10GE Crossponder
		10DME-C (MSTP)	10Gbps Data MuxPonder - EFEC - Full C-Band Tunable
		OSC-CSM (MSTP)	ONS 15454 Combiner and Separator with OSC Module
		MR-L1-58.1 (MSTP)	Multi-Rate Txp 100M-2.5G 100G 4ch 1558.17-1560.61
		10E-L1-C (MSTP)	15454 10G Multi-Rate Transponder- EFEC- Full C-Band Tunable
		10ME-L1-C (MSTP)	15454 4x2.5Gbps-10Gbps MuxPonder- EFEC- Full C-Band Tunable

Table 2-3. Tested System Configurations (continued)

System		Module	Description
SUT With software release 8.0.0 (08.00-007A-27.16)	The modules listed were all tested in both the MSPP and MSTP and are interchangeable for the MSPP and MSTP configurations.	ONS-XC-10G-S1	XFP – OC192/STM64/10GE – 131- SR – SM LC
		ONS-XC-10G-L2	XFP – OC192/STM64 – 1550 LR2 – SM LC
		ONS-XC-10G.58.9	SFP- OC-192/STM64/10GE, 1558.98, 100 GHz, LC
		ONS-XC-2G.58.9	SFP- OC-48/STM16, 1558.98nm, 100 GHz, SM, LC
		ONS-SE-G2F-SX	SFP- GE/1G-FC/2G-FC- 850nm- MM-LC
		ONS-GC-GE-SX	GBIC- 1000Base-SX, SC, MM
		ONS-SI-155-I1	SFP- OC3/STM1 IR1/S-1.1 1310 SFP, ITEMP
		ONS-SI-622-I1	SFP- OC12/STM4 and OC3/STM1 IR, S-4.1, S-1.1, 1310 nm, ITEMP
		ONS-SI-2G-I1	SFP- OC48/STM16, IR1, S-16.1, 1310nm, SM, LC, ITEMP
		ONS-SE-Z1	SFP- OC48IR1, 12/3SR1, GE LX STM S-16.1, I-4, I-1, 1310nm EXT-TEMP
	Management Terminal	Sun Server: 80 GB hard drive, 512 MB RAM, Intel Celeron Processor 2.80 GHz, Windows XP with Service Pack 2, Cisco Transport Controller Running Release 8.0.0, Cisco Transport Manager Release 8.0 build 863	

LEGEND:

5ESS	- Class 5 Electronic Switching System	Mbps	- Megabits per second
CL	- Customer Location	MSPP	- Multiservice Provisioning Platform
CS	- Communication Server	MSTP	- Multiservice Transport Platform
DS1	- Digital Signal Level 1	MX	- Multiplexer
DS3	- Digital Signal Level 3	NE	- Network Element
EWSD	- Elektronisches Wählsystem Digital	ONS	- Optical Network System
GB	- Gigabytes	OPTI	- Optical
Gbps	- Gigabits per second	RAM	- Random Access Memory
GHz	- Gigahertz	SFP	- Small Form Factor Pluggable
MA	- Metro Access	SUT	- System Under Test
MB	- Megabytes	TCC2P	- Timing, Communications, and Control version 2 Plus

10. TEST LIMITATIONS. None.

11. TEST RESULTS

a. Discussion

(1) Synchronization. The SUT can derive timing from a physical link or from a Building Integrated Timing Source (BITS). During this test, the timing was derived from the BITS timing source on one 15454 node. The other nodes derived their timing from the fiber links that were connected to the node with the BITS timing source.

(2) Device Management.

(a) Management Option. The SUT is managed via the CTC application. CTC is a Java application that is stored on the Timing, Communications, and Control version 2 (TCC2) or the Timing, Communications, and Control version 2 Plus (TCC2P) card. After logging into the ONS 15454 for the first time, the CTC application is downloaded to the workstation. The workstation tested was running the Windows XP operating system and connected to the gateway node via a Category 5 network cable. The workstation with the CTC application served as a management console, and it managed all nodes in the test network via in-band management.

(b) Fault Management. The SUT does not support fault management as defined in the GSCR, appendix 9. This requirement is conditional and has no operational impact on network interoperability.

(c) Loop Back Capability. The SUT does not support International Telecommunications Unit (ITU) Recommendation V.54 "Loop Test Devices For Modems" as defined in the GSCR, appendix 9. This requirement is conditional and has no operational impact on network interoperability.

(d) Operational Configuration Restoral. The SUT was placed into a power failure condition. The SUT returned to the last customer configured state prior to the power failure as required in the GSCR, appendix 9.

(3) Security. Security is tested as part of the Information Assurance testing and is covered under a separate report.

(4) DSN Access Interfaces. The SUT supports both DS1 and DS3 interfaces. Channel Associated Signaling (CAS) and Common Channel Signaling trunks were provisioned and tested. In addition, the SUT supports 10/100Mbps, Gigabit, and 10 Gigabit Ethernet interfaces. All of the interface types were mapped through the test network via VT1.5 and STS-1 transport levels over all of the supported SONET interfaces described in paragraph (5). The specific requirements and test results of the DSN Access Interface testing are described below.

(a) Interface Characteristics. The DS1 and DS3 interfaces characteristics were tested according to GSCR, appendix 9. The DS1 interface supports both Alternate Mark Inversion (AMI) and Bipolar Eight Zero Substitution (B8ZS) line coding, as required by the GSCR, appendix 9. The DS3 interface supports both C-bit and M13 framing. All Access interface characteristics were verified through both vendor Letter of Compliance (Loc) and testing.

(b) Supervisory CAS. Trunk seizure, answer supervision, preemption signals and all other trunk supervisory information sent and received on a per channel basis was passed transparently through the SUT as required in the GSCR, appendix 9.

(c) Clear Channel Capability. The SUT is capable of transmitting and receiving B8ZS line coding as required in the GSCR, appendix 9.

(d) Alarm and Restoral Requirements. The SUT is capable of transparently passing the alarm and restoral features of the DSN switch's digital interface unit as required in the GSCR, appendix 9.

(e) Mean Opinion Score (MOS). The Abacus call loader was used to generate voice traffic across the DS1 links and the IXIA was used to generate voice and data Internet Protocol (IP) traffic through the Ethernet links. All links were mapped through the SONET test network as depicted in figure 2-2. There were 108,154 calls placed over the DS1 links, with 99.99 percent of all calls placed via the SUT having an MOS of 4.0 or greater. The Ixia IxChariot generated 2074 Voice over Internet Protocol (VoIP) test pairs. The average MoS reading was 4.37 for all calls. The GSCR,

appendix 9, states that a Network Element shall have a MOS of 4.0 or better for 95 percent of all calls placed.

(f) Bit Error Rate Tests (BERTs). BERTs were conducted across DS1 and DS3 interfaces. The GSCR, appendix 9, requires that the SUT, when inserted in to the test network, will not exceed an end-to-end bit error ratio of less than one error in $1x10^{9}$ (averaged over a nine hour period). The SUT met this requirement for all interfaces with a recorded bit error ratio of $1x10^{-12}$ for all DSN access interfaces.

(g) Secure Transmission (Voice and Data). There were 126 secure calls placed between Secure Terminal Equipment (STEs) and Secure Wireline Terminals (SWTs) without degrading transmissions between end devices. This satisfies the GSCR, appendix 9, requirement for degraded transmissions.

(h) Modem. There were 50,973 modem calls placed through the SUT using the Abacus call loader. All modem calls had a transmission rate of 26.4 kilobits per second (kbps). The SUT supports the minimum modem transmission speed of 9.6 kbps as required in the GSCR, appendix 9.

(i) Facsimile. There were 8,594 facsimile calls placed through the SUT using the Abacus call loader. All facsimile calls had a transmission rate of 14.4 kbps. The SUT supports the minimum modem transmission speed of 9.6 kbps as required in the GSCR, appendix 9.

(j) Call Control Signals. The SUT transparently transported all Multi-Level Precedence and Preemption (MLPP) call control signals as required in the GSCR, appendix 9.

(k) Call Congestion. In accordance with the GSCR, appendix 9, call congestion handling can be met one of the following three ways: dynamic load control signal; software capability which makes congestion impossible; or congestion is not possible in the SUT. Call congestion in the SUT is not possible.

(l) Voice Compression. Voice compression is not a feature provided by the SUT. This requirement is conditional and has no operational impact on network interoperability.

(m) Delay. Delay is the measurement of time for a packet to travel from origination to destination. The GSCR, appendix 9, paragraph A9.5.1.2.9a, states the addition of Strategic Network Element (S-NE) shall not cause the one-way packet delay measured from ingress to egress to increase by more than five milliseconds (ms) for each S-NE used, averaged over any five-minute period. The average one-way delay for each of the sampled five-minute periods, measured between NE devices, was 0.7 ms, with a maximum delay of 1.0 ms, which met the requirement.

(n) Jitter. Jitter is a timing variation of the inter-packet gap, which is the time between the arrival of packets. The GSCR, appendix 9, paragraph A9.5.1.2.9b, states the addition of S-NE shall not cause jitter measured from ingress to egress to increase by more than five ms or less averaged over any five-minute period. With a bandwidth load, jitter was measured to be 0.003 ms over a five-minute period, which met the requirement.

(o) Packet Loss. Packet loss occurs when packets are sent, but not received at the final destination. The GSCR, appendix 9, paragraph A9.5.1.2.9c, states that the addition of an S-NE shall not cause packet loss measured from ingress to egress to increase by more than 0.05% averaged over any five-minute period. With bandwidth load, the measured packet loss was 0.00% over a five minute period.

(5) DSN Transport Interfaces. The SUT supports SONET standard optical carrier link levels of OC-3, OC-12, OC-48, OC-192, and DWDM. The respective optical carrier links were tested and certified for the architectures depicted in table 2-4.

Table 2-4. SUT Certified SONET Architectures

Optical Carrier Link Level	Certified Architecture
OC-192	UPSR, BLSR, LAPS (1+1)
OC-48	UPSR, BLSR, LAPS (1+1)
OC-12	UPSR, LAPS (1+1)
OC-3	UPSR, LAPS (1+1)
LEGEND: BLSR - Bidirectional Line Switched Ring LAPS - Linear Automatic Protection Switching OC-3 - Optical Carrier Level 3 OC-12 - Optical Carrier Level 12 OC-48 - Optical Carrier Level 48	OC-192 - Optical Carrier Level 192 SONET - Synchronous Optical Network SUT - System Under Test UPSR - Unidirectional Path Switch Ring

(a) Military Unique Features. The SUT supports the full complement of Military Unique Features as required in the GSCR, section 3. The following types of MLPP calls were placed over all the SUT transport and access interfaces between the switching systems listed in table 2-3. All calls were completed successfully and met the MLPP interactions as required by the GSCR, section 3.

1. Circuit for Reuse; Answered Call
2. Circuit for Reuse; Unanswered Call
3. Circuit not for Reuse; Answered Call
4. Circuit not for Reuse; Unanswered Call
5. Resources not Available (Intra- and inter-switch)
6. Circuit for Reuse; Answered Call (simultaneous preemption of line and trunk)
7. Circuit for Reuse; Unanswered Call (simultaneous preemption of line and trunk)

(b) Generic Requirement (GR)-303-CORE. The SUT was compliant with GR-303-CORE. This requirement was verified via the vendor's Letter of Compliance (LoC).

(c) GR-253-CORE. The SUT was compliant with GR-253-CORE. This requirement was verified via the vendor's LoC.

(d) GR-782-CORE. The SUT was compliant with GR-782-CORE. This requirement was verified via the vendor's LoC.

(e) ANSI T1.105-2001. The SUT was compliant with ANSI T1.105-2001. This requirement was verified via the vendor's LoC.

(f) DS1 Rate Transport via VT1.5. All features and functions that are defined to operate at the DS1 rate worked transparently at the VT1.5 rate over the SUTs SONET interfaces, as required in the GSCR, appendix 5.

(g) DS1 Rate Provisioning. The SUT supports the provisioning of transport levels as low as the DS1 rate as required in the GSCR, appendix 5.

(h) DS0 to OC-3 Route Assignment. The SUT supported this requirement by transparently passing all trunk group(s) mapped through the test network as required in the GSCR, appendix 5.

(i) Facility Alarms. The SUT supported all facility alarms as required in the GSCR, appendix 5.

(j) DS1 Alarm Indication Signal (AIS: Blue Alarm) and DS1 Remote Alarm Indication (RAI: Yellow Alarm). The SUT transparently transported all DS1 Alarm Indication Signals and Yellow alarms as required in the GSCR, appendix 5.

(k) DS0 AIS/DS0 RAI/Yellow. The SUT transparently passed all DS0 level alarms required in the GSCR, appendix 5.

(l) Synchronization. The SUT was compliant with Synchronization GR-253-CORE, GR-436-CORE, and GR-518-CORE as required in the GSCR, appendix 5. This requirement was verified via the vendor's LoC.

(m) Reliability. The SUT was compliant with the reliability requirement as stated in the GSCR, appendix 5. This requirement was verified via the vendor's letter of compliance.

(n) Security. Security is tested as part of the Information Assurance testing and is covered under a separate report.

(o) MOS. The Abacus call loader was used to generate voice traffic across the DS1 links. The IXIA was used to generate VoIP pairs and data IP traffic through the Ethernet links. All links were mapped through the SONET test network as depicted in figure 2-2. There were 108,154 calls placed over the DS1 links, with 99.99 percent of all calls placed via the SUT having an MOS of 4.0 or greater. With 2074 Ixia IxChariot VoIP pairs generated, the average MoS was 4.37. The SUT met the GSCR requirement, appendix 9, which states that a Network Element shall have a MOS of 4.0 or better for 95 percent of all calls placed.

(p) BERT. BERTs were conducted across T1 and DS3 interfaces. The GSCR, appendix 9, requires that the SUT, when inserted in to the test network, will not exceed an end-to-end bit error ratio of less than one error in $1x10^{9}$ (averaged over a nine hour period). The SUT met this requirement for all interfaces with a recorded bit error ratio of $1x10^{-12}$ for all DSN transport interfaces.

(q) Secure Transmission (Voice and Data). There were 126 secure calls placed between STEs and SWTs without degrading transmissions between end devices. This satisfies the GSCR, appendix 9, requirement for degraded transmissions.

(r) Modem. There were 50,973 modem calls placed through the SUT using the Abacus call loader. All modem calls had a transmission rate of 26.4 kbps. The SUT supports the minimum modem transmission speed of 9.6 kbps as required in the GSCR, appendix 9.

(s) Facsimile. There were 8,594 facsimile calls were placed through the SUT using the Abacus call loader. All facsimile calls had a transmission rate of 14.4 kbps. The SUT supports the minimum modem transmission speed of 9.6 kbps as required in the GSCR, appendix 9.

(t) Call Control Signals. The SUT transparently transported all MLPP call control signals as required in the GSCR, appendix 9.

(u) Delay. There were 2074 VoIP pairs generated through the SUT using the Ixia. In accordance with the GSCR, appendix 9, the SUT supported the requirement that the S-NE shall not cause the one-way packet delay measured from ingress to egress to increase by more than five ms for each S-NE used, averaged over any five-minute period.

(v) Jitter. With 2074 VoIP pairs generated through the SUT using the Ixia, the SUT supports the requirement that the addition of an S-NE shall not cause jitter measured from ingress to egress to increase by more than 5 ms averaged over any five-minute period.

(w) Packet Loss. The Ixia generated 2074 VoIP pairs through the SUT. The requirement that the addition of an S-NE shall not cause packet loss measure from

ingress to egress to increase by more than 0.05% averaged over any five-minute period is supported by the SUT.

(x) Call Congestion. In accordance with the GSCR, appendix 9, call congestion handling can be met one of the following three ways: dynamic load control signal; software capability which makes congestion impossible; or congestion is not possible in the SUT. Call congestion in the SUT is not possible.

(y) Voice Compression. Voice compression is not a feature provided by the SUT. This requirement is conditional and has no operational impact on network interoperability.

b. Summary. The SUT is certified for joint use within the DSN as a S-NE in accordance with the requirements set forth in reference (c). When connected to the interfaces certified in this letter, the SUT and its associated applications were transparent to the switching systems interfaced causing no degradation of service or negative impact.

12. TEST AND ANALYSIS REPORT. No detailed test report was developed in accordance with the Program Manager's request. JITC distributes interoperability information via the JITC Electronic Report Distribution (ERD) system, which uses Unclassified-But-Sensitive Internet Protocol Router Network (NIPRNet) e-mail. More comprehensive interoperability status information is available via the JITC System Tracking Program (STP). The STP is accessible by .mil/gov users on the NIPRNet at https://stp.fhu.disa.mil. Test reports, lessons learned, and related testing documents and references are on the JITC Joint Interoperability Tool (JIT) at http://jit.fhu.disa.mil (NIPRNet), or http://199.208.204.125 (SIPRNet). Information related to DSN testing is on the Telecom Switched Services Interoperability (TSSI) website at http://jitc.fhu.disa.mil/tssi.